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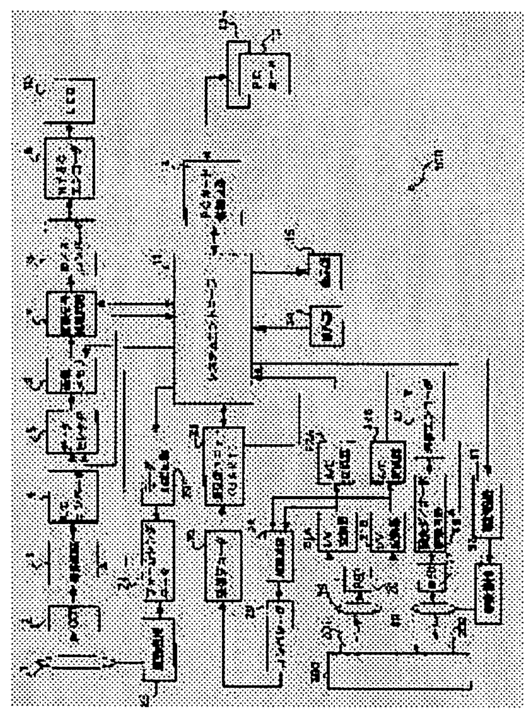
(54) **CAMERA WITH INFRARED RAY COMMUNICATION FUNCTION**

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a camera with an infrared ray communication function while satisfying requirements of miniaturization and low cost.

SOLUTION: A digital camera 100 storing a picked-up image as digital data uses infrared ray projection sections 17, 18 and infrared ray receiving sections 19, 20 for trigonometrical range finding to make data communication with an external device 200. Furthermore, the luminous intensity for the data communication is selected smaller than the luminous intensity for the trigonometrical range finding, and in the case of making data communication, a light spread over a prescribed angular range is adopted for the emitted infrared ray in the case of making the data communication.



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* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] A camera with infrared communication facility characterized by performing an external instrument and data communication using the infrared light floodlighting section and an infrared light light sensing portion for performing triangular ranging.
[Claim 2] Said camera is a camera with infrared communication facility according to claim 1 which is a digital camera which holds a photoed image as digital data, and is characterized by transmitting said digital data by said data communication.
[Claim 3] An output of infrared light injected from said infrared light floodlighting section is a camera with infrared communication facility according to claim 1 or 2 characterized by being more large when a direction in a case of performing said triangular ranging performs said data communication.
[Claim 4] Infrared light injected from said infrared light floodlighting section is a camera with infrared communication facility given in either of claims 1-3 characterized by being parallel light when performing said triangular ranging, and being the light which it diffuses in a predetermined angle range in performing said data communication.
[Claim 5] A camera with infrared communication facility characterized by having a transmission-control means to drive said floodlighting means further in a camera characterized by providing the following based on said digital image data stored in said storage means An image pick-up means to receive light from a photographic subject and to generate digital image data A storage means to store said digital image data A floodlighting means to floodlight infrared light for said photographic subject A light-receiving means to receive said infrared light reflected by said photographic subject, and an operation means to calculate distance to said photographic subject based on a location where said light-receiving means received said said reflected infrared light
[Claim 6] Said transmission-control means is a camera with infrared communication facility according to claim 5 characterized by driving said floodlighting means and outputting serial data of a predetermined format.
[Claim 7] Said transmission-control means is a camera with infrared communication facility according to claim 6 characterized by making time amount shorter than a time interval per bit of said serial data into drive time amount per bit of said floodlighting means.
[Claim 8] A camera with infrared communication facility characterized by having a reception-control means characterized by providing the following to store in said storage means further data of a predetermined format which said light-receiving means received in a camera An image pick-up means to receive light from a photographic subject and to generate digital image data A storage means to store said digital image data A floodlighting means to floodlight infrared light for said photographic subject A light-receiving means to receive said infrared light reflected by said photographic subject, and an operation means to calculate distance to said photographic subject based on a location where said light-receiving means received said said reflected infrared light
[Claim 9] A camera with infrared communication facility according to claim 8 characterized by having further a display means for displaying digital image data stored in said storage means.
[Claim 10] A camera with infrared communication facility given in either of claims 5-7 which is characterized by providing the following Said floodlighting means is the light source which injects infrared light. It has a migration device to which a floodlighting lens arranged at a photographic subject side and said floodlighting lens are moved in accordance with an optical axis from said light source.

Said transmission-control means When said floodlighting means and said light-receiving means are used for an operation of distance to said photographic subject, injection light from said floodlighting lens turns into parallel light. ** to which said migration means is controlled and said floodlighting lens is moved so that injection light from said floodlighting lens may diffuse in the predetermined range in case said floodlighting means is driven based on said digital image data

[Claim 11] Said transmission-control means is a camera with infrared communication facility given in either of claims 5-7 characterized by having a conversion means to change into a predetermined format said image data stored in said storage means.

[Claim 12] Said floodlighting means has a drive circuit which drives the light source which injects infrared light, and said light source. Said drive circuit is constituted so that injection luminous intensity of said light source can be changed. Said transmission-control means In case said floodlighting means is driven based on said digital image data A camera with infrared communication facility given in either of claims 5-7 characterized by controlling said drive circuit so that injection luminous intensity of said light source becomes small rather than a case where said floodlighting means is driven in order to find distance to said photographic subject.

[Claim 13] A camera with infrared communication facility which has both a transmission-control means according to claim 5 and a reception-control means according to claim 8.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] It is related with a camera with infrared communication facility with possible this invention performing an external instrument and data communication, such as a computer, using infrared radiation.
[0002] The photoed image is stored as digital data in recent years, and the digital camera which can transmit data to a personal computer etc. has spread. Usually, the data transfer between a digital camera and a computer connects both by the predetermined cable (for example, SCSI or a RS-232C cable), and performs them.
[0003]
[Problem(s) to be Solved by the Invention] As for pocket equipments, such as a digital camera, the data communication in a going-out place may become **. However, in case a camera is carried, when it is troublesome to also always carry a cable and the models of computer differ, since the connector configurations of a cable may differ, the data communication in a going-out place is difficult for the actual condition.
[0004] In view of the above situations, the specification of IrDA which performs data communication between a personal digital assistant and a computer using infrared radiation is advocated, and the computers equipped standardly with this specification are increasing in number in recent years.
[0005] However, since it led to enlargement of the body, and a cost rise, in the field of the camera with which a miniaturization and low-pricing are demanded, adoption was difficult for adding the above infrared communication facility other than the photography function of a camera.
[0006]
[Means for Solving the Problem] For this reason, a camera with infrared communication facility of this invention was considered as a configuration which performs an external instrument and data communication using the infrared light floodlighting section and an infrared light light sensing portion for performing triangular ranging. Here, if said camera is a digital camera which holds a photoed image as digital data, it can transmit said digital data by said data communication.
[0007] Output reinforcement of infrared light injected from said infrared light floodlighting section can make reinforcement when performing said data communication smaller than reinforcement in a case of performing said triangular ranging. Moreover, when performing said data communication, as for infrared light injected from said infrared light floodlighting section, it is desirable [when performing said triangular ranging, it is parallel light, but] to consider as light diffused in a predetermined angle range.
[0008]
[Embodiment of the Invention] The digital camera as a gestalt of operation of this invention is a camera which has the ranging section of the active method equipped with the infrared light emitting/receiving device, and is stored in the storage section by using a photography image as digital data.
[0009] Drawing 1 is a block diagram for explaining the configuration of the digital camera 100 which is the gestalt of implementation of invention. A photographic subject image is formed in the light sensing portion of CCD2 with a taking lens 1. CCD2 outputs the image pick-up signal corresponding to a photographic subject image to the image pick-up circuit 3. The signal sent from CCD2 is changed into

an RGB code in the image pick-up circuit 3. The RGB code outputted from the image pick-up circuit 3 is changed into a digital signal by the A/D converter, and is sent to a data selector 5. Although a data selector 5 is explained later, it is a circuit for outputting alternatively the output data of A/D converter 5 which were picturized by CCD2 and changed into image data, and the data sent from the external instrument by communication link to the image memory 6 of the next step. The data outputted from the data selector 5 is stored in an image memory 6 synchronizing with the clock signal outputted from a system controller 11.

[0010] The data stored in the image memory 6 sends data to the picture signal processing circuit 7 first. The picture signal processing circuit 7 is a circuit which performs a gamma correction, compression at the time of data logging, etc. The display of an image is performed as follows. Image data is outputted to D/A converter 8 from the picture signal processing circuit 7. Image data is changed into an analog picture signal by D/A converter 8, is changed into an NTSC picture signal by the NTSC encoder 9, and is transmitted and displayed on the LCD monitor 10.

[0011] In recording image pick-up data, the image data compressed through the system controller 11 to the PC card control circuit 12 from the picture signal processing circuit 7 is transmitted, and it writes data in PC card 13 in a predetermined format. In addition, PC card 13 is inserted in card unit 13A prepared in the camera 100, and the writing of data is performed.

[0012] In addition, in a system controller 11, it has the control unit 14 in which the usual image pick-up, the data writing to a card 13, and the various operating members for performing data communication mentioned later were prepared. Moreover, the display 15 for displaying the operating state of a camera etc. is formed independently [the LCD monitor 10].

[0013] Next, ranging is explained. The active ranging line which used infrared light is in this digital camera 100. Although this is mentioned later in detail, it is the method of receiving the infrared light which was floodlighted from the floodlighting section and reflected by the photographic subject by the light sensing portion using a triangular ranging method, and calculating and finding photographic subject distance based on the light-receiving location.

[0014] A system controller 11 sends the control signal for a drive to the light emitting diode drive circuit 16 in order to make the infrared light light emitting diode (IRED) 17 for emitting light in infrared light emit light. The infrared light light emitting diode 17 is driven by the drive circuit 16, and emits light in infrared light. Infrared light turns into parallel light through the floodlighting lens 18, and is irradiated towards a photographic subject.

[0015] The infrared light reflected by the photographic subject is received by the photo sensor (PSD) 20 through the light-receiving lens 19. Although later mentioned about structure, a photo sensor 20 outputs current to current / voltage (I/V) converters 21A and 21B by the ratio (photographic subject distance was embraced) according to a light-receiving location. The output value (voltage value) of the I/V converters 21A and 21B is changed into digital value by A/D converters 22A and 22B, and is sent to a system controller 11. A system controller 11 calculates the distance to a photographic subject based on the input data from A/D converters 22A and 22B, drives a lens 1 based on the distance to a photographic subject, and is made to move it to a focus location. Migration of a lens 1 controls the motorised circuit 23, drives the focusing motor 24, and is performed by moving a lens 1 in the direction of an optical axis with the lens drive 25.

[0016] In case the transceiver unit (UART) 26 performs data communication, it generates the data of a predetermined data format. According to the data in the image memory changed into the data of a predetermined format by the transceiver unit 26, data transmission is performed, when the infrared transmitting encoder 27 outputs the driving signal of the light emitting diode drive circuit 16. Moreover, a photo sensor 20 receives the light-receiving light at the time of data communication, and the voltage value outputted by the I/V converters 22A and 22B is added by the adder circuit 28. A predetermined reference value and a predetermined comparator 29 compare the output value of an adder circuit 28, and binary data is obtained. The binary data outputted from a comparator 29 is changed into the data of a predetermined format by the receiving decoder 30, and is sent to the transceiver unit 26.

[0017] In addition, although mentioned later in detail, it is with the time of data communication and ranging, and the floodlighting angle range of the infrared radiation to floodlight is changed. When measuring photographic subject distance, it is desirable to floodlight parallel light. It is desirable to establish tolerance in ** and a light-receiving range on the other hand, in order to make easy alignment

(adjustment of the physical relationship of both floodlighting section and light sensing portions) with an external instrument at the time of data communication. In this digital camera, in order to change a floodlighting range, the configuration which moves the floodlighting lens 18 in the direction of an optical axis is taken by driving a drive 32 through the drive circuit 31.

[0018] When the digital camera 100 constituted as mentioned above performs an external instrument 200 and data communication, such as a computer, the light sensing portion 202 of an external instrument 200 receives the infrared light injected from the floodlighting lens 18 of a digital camera 100, and the floodlighting section 201 of an external instrument 200 floodlights infrared light towards the light-receiving lens 19 of a digital camera 100.

[0019] The principle of triangular ranging is shown in drawing 2 and drawing 3 . In drawing 2 , if distance of the optical axis of the light-receiving lens 19 on f and the light-receiving side of a sensor 20 and the incidence location of incident light is set [the distance from the floodlighting lens 18 of a camera 100 to a photographic subject S / the distance between the opticals axis of d, the floodlighting lens 18, and the light-receiving lens 19] to x for the distance to the light-receiving side of A, the light-receiving lens 19, and a sensor 20, the relation of a degree type (1) will be materialized.

d=A-f/x ...... (1)

[0020] Drawing 3 is the cross section showing the structure of a sensor 20. A sensor 20 consists of P layer, I layer, and an N layer, and P layers have become a light-receiving side. In the P layer surface, the output electrodes Ea and Eb of a pair are formed in both ends. The inside O of drawing is the optical axis of the light-receiving lens 19, and sets the electrode Ea of a pair, and distance between Eb(s) to L. Suppose that the reflected light from a photographic subject carried out incidence as shown in drawing (location separated from the optical axis O x to the drawing Nakamigi hand side). From being Ia+Ib=Io and being Ia=1/2x(1-2/Lxx) xIoIb=1/2x(1+2-/Lxx) xIo, when the photocurrent generated at this time is set to Io and the output current of Electrodes Ea and Eb is set to Ia and Ib, respectively x=L/2x(Ib-Ia)/ (Ia+Ib) ... (2)

**** ****. (2) From a formula, by measuring Ia and Ib, distance x is found and the distance d to a photographic subject is further acquired from distance x by (1) type.

[0021] Drawing 4 is drawing showing the format (UART format) of the data in the transceiver unit 26. The data format in the transceiver unit 26 is serial data which consists of 10 bits per frame of 1 bit of start bits, 1 bit of stop bits, and 8 bit [of data bits] **. This data is outputted and inputted synchronizing with a predetermined clock.

[0022] Drawing 5 shows the format (IR format) of the data used for infrared data communication with an external instrument. The serial data shown in drawing 4 transmitted to the transmitting encoder 27 from the transceiver unit 26 is modulated by the format shown in drawing 5 in the transmitting encoder 27. Moreover, the data received by the sensor 20 has the format shown in drawing 5 , and this gets over to the format of drawing 4 by the receiving decoder 30, and it is sent to the transceiver unit 26.

[0023] The pulse width as which the format of drawing 5 expresses the information on the bit to the period of 1 bit is 3/16. That is, in the data frame at the time of data communication, it is considered to the time amount width of face per [which is specified with a clock] bit only by only the time amount of 3/the 16 setting infrared light to ON that the information on the bit is 1. Therefore, since a light emitting diode drives based on the format of drawing 5 at the time of data transmission, ON information can be transmitted by luminescence of time amount shorter than the period of 1 bit, and as a result, there is little power consumption and it ends.

[0024] Drawing 6 and drawing 7 are drawings showing the location of the floodlighting lens at the time of ranging and data communication. Drawing 6 shows the location of the floodlighting lens in the case of ranging. When performing ranging, even as for a photographic subject, it is desirable to irradiate light with little attenuation. For this reason, a floodlighting lens is put on the location whose focus of that corresponds with light emitting diode mostly, and it is made for parallel light to be irradiated towards a photographic subject.

[0025] Drawing 7 is drawing showing the location of the floodlighting lens at the time of data communication. Data communication aims at the communication link of 1 to 1 with an external instrument and a digital camera. In this case, the distance between devices is comparatively near. It is required for the light sensing portion of an external instrument at the time of data communication that infrared light should be projected certainly. That is, the light of the infrared light floodlighted from a

viewpoint of making easy alignment of the floodlighting section of a digital camera and the light sensing portion of an external instrument diffused in a certain within the limits is more desirable. For this reason, he brings a floodlighting lens close to a light emitting diode side, and is trying for exposure light to diffuse it rather than the case of drawing 6 at the time of data communication.

[0026] Drawing 8 is drawing showing the drive circuit of light emitting diode. At the time of ranging, since it is necessary to receive the reflected light from a photographic subject, it is necessary to inject a comparatively strong light from light emitting diode. As for the luminescence reinforcement of light emitting diode, it is desirable to make it comparatively small so that it may not be affected on the other hand to any receiving sets other than the device which is going to think that an external instrument is in a comparatively near location, and is going to transmit ****** and data at the time of data communication.

[0027] At the time of photographic subject distance ranging, from a system controller, an ON signal is supplied to the both sides of Terminals TA and TB, and luminescence reinforcement is altogether strengthened by setting transistors Q1, Q2, and Q3 to ON. At the time of data communication, the input to TA and TB from a system controller presupposes that it is off, and supplies a driving signal to Terminal TA from a transmitting encoder. Since only a transistor Q1 serves as ON when only TA is ON, the amount of luminescence of light emitting diode decreases.

[0028] Drawing 9 - drawing 11 are flow charts which show the motion control of this digital camera. This digital camera can operate by five modes of operation. the mode which records the data in the (1) recording-mode:image memory 6 on a PC card with five modes of operation, and the mode which displays the data in an image memory 6 on LCD and (2) playback-mode:(3) washout mode :P the mode which eliminates the data in C card 13, the mode in_which the data in the (4) transmitting-mode:image memory 6 is transmitted by infrared ray communication, and the mode which writes in the data received by infrared ray communication in the (5) receive-mode:image memory 6 -- it comes out. These modes are chosen by actuation of the mode selection switch (not shown) formed in the control unit 14.

[0029] In the flow chart of drawing 9 , by S1, S3, S5, S7, and S9, it detects whether which mode of operation is chosen among the above-mentioned modes of operation, and switches to the mode in which the mode of operation of a camera was chosen (S2, S4, S6, S8 or S10). In addition, as mentioned above, in performing data communication using infrared light between a digital camera 100 and the external instruments (computer etc.) 200 which are communications partners and choosing a transmitting mode or the receive mode, the user performs both alignment. If a mode of operation is switched to a transmitting mode or the receive mode, a system controller 11 will perform a negotiation between external instruments 200, and will perform a setup of communication link conditions etc.

[0030] Next, as shown in drawing 10 and 11, processing for every mode is performed. When a recording mode is chosen, it is judged with Y by S21 of drawing 10 . The release carbon button (not shown) of a camera 100 functions as an output means (S22) of a record trigger. If a release carbon button is pushed, it is judged with the record trigger having been outputted (Y:S22), and ranging by the above-mentioned triangular ranging method is performed, the focusing motor 24 will be driven and a focusing glass 1 will be moved to the location (focus location) corresponding to the distance to a photographic subject with a drive 25 (S24). And after image data is memorized in an image memory 6 based on the picture signal outputted from CCD2, it is compressed and is written in PC card 13 (S25).

[0031] When a playback mode is chosen, it is judged with Y by S31 of drawing 10 . In a playback mode, a release carbon button functions as a playback trigger output means. That is, playback of data will be started, if a release carbon button is pushed in a playback mode and the data in image memory is not [be / it] under playback at the time (N:S33) (S35). Playback of data is performed as follows.

[0032] Image data is first transmitted to an image memory 9 through the PC card control circuit 12 and a system controller 11 from PC card 13. The data of an image memory 9 is compressed data, elongation of compressed data is performed in the picture signal processing circuit 7, and it is changed into an analog signal by D/A converter 8, is changed into an NTSC video signal with an NTSC encoder, and is displayed on LCD10.

[0033] Moreover, when a release carbon button is pushed during playback of the data in an image memory in a playback mode, (Y:S33) and playback are suspended (S34). Therefore, in a playback mode, playback can be started and suspended by pushing a release carbon button.

[0034] When washout mode is chosen, it is judged with Y by S41 of drawing 10 . In this case, an

elimination trigger is outputte[illegible] operating the elimination carbon butt[illegible] (not shown) prepared in the control unit. Detection of an el[illegible]ation trigger eliminates the data in P[illegible]ard 13 (S43). (S42) In addition, elimination of data is performed by actuation of the elimination carbon button prepared independently instead of a release carbon button in order to avoid disappearance of the data based on an operation mistake.

[0035] When a transmitting mode is chosen, it is judged with Y by S51 of drawing 11 . In a transmitting mode, a release carbon button functions as a transmitting trigger output means. If a release carbon button is operated and a transmitting trigger is detected (Y:S52), when data is in an image memory, it will restrict (Y:S53), and data transmission will be performed using infrared light. When there is no data into an image memory, (N:S53) and transmitting processing are not performed.

[0036] When the receive mode is chosen, it is judged with Y by S61 of drawing 11 . If the receive mode is chosen, a system controller will go into a data reception standby condition. That is, since it is judged with N by S63 until data is sent from an external instrument, S62 and S63 are repeated.

[0037] It is judged in S62 whether the receive mode reset command was issued. When this camera is operating by the receive mode and data is not transmitted from the device of the other party, it is judged with N by S63 as mentioned above, and processing returns to S62. When data transmission from the device of the other party is no longer performed under a certain situation, a data waiting state (namely, loop which returns to S62 from S63) will continue.

[0038] Then, S62 is judged in order to exit from the loop of the waiting for this data. That is, at the time of a data waiting state, when a command of which the receive mode is canceled is emitted by a certain actuation (when a mode selection switch is operated, for example and the modes other than the receive mode were chosen), it is judged with Y by S62, and processing returns to S1 by it. In the normal state to which actuation in which especially the receive mode is canceled is not performed, the judgment by S62 serves as N, and the processing which returns from S63 to S62 is repeated to data arrival.

[0039] If the signal which shows the data transmitting initiation from an external instrument is received (Y:S63), data will be received and it will write in an image memory (S64). Termination of the data writing to an image memory displays the data which completed data reception, next was written in the image memory (S65). If a release carbon button is pushed while the image is displayed on LCD, the contents of the image memory will be recorded on a PC card (S67). (if a record trigger is detected) When a record trigger is not detected in time amount predetermined in the condition that the image was displayed on LCD, playback of (N:S66 and Y:S68), and the received image is suspended, and processing is ended.

[0040] As mentioned above, infrared ray communication can be made possible, without [without according to the camera with infrared communication facility of this invention it writes supposing that the infrared emitting diode for ranging is used also for the data transmission to an external instrument, and using the same photo detector for ranging for reception of the data communication by the infrared light from an external instrument and enlarges a camera, and] using special components.

[0041] Moreover, at the time of data communication, compared with the time of ranging, the output of light emitting diode can be made small and the increment in the power consumption by having communication facility can be suppressed. Furthermore, at the time of data communication, since it constituted so that the flux of light from a light-emitting part might diffuse at an angle of predetermined, alignment with the device of the communicative other party is easy.

[Translation done.]